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ABSTRACT

By filming and coding the eye movement patterns of poor readers, the effectiveness of various experimental segments of "The Electric Company" to draw attention to printed material on screen was tested. Twenty-two segments of the program were shown to 30 nine to eleven year olds divided into poor readers and non-readers. Analysis of the data pointed out differences between poor and non-readers in direction of fixation, duration and effectiveness of eye movements per second, and in perseverance of attack. (EMH)

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Research Report 1972/73

Experimental Program Eye Movement Study

by

K.G. O'Bryan and Harry Silverman

1. Problem:

To examine, through a study of the eye movement patterns of poor readers, the effectiveness of various experimental segments of the "Electric Company" in gaining and directing attention to print.

2. Method:

(i) Apparatus. Corneal reflection techniques using a Mackworth Stand Camera were used. Stimuli were presented on a V.T.R.-fed nine-inch television monitor at a viewing distance of 26.5". Corneal reflections were photographed at 16 frames per second by Beaulieu 16 mm electric drive camera on 400 A.S.A. Kodak 7277 reversal film. Subjects were seated at the camera on a soft swivel chair with back padding for stability and comfort. A chin rest and head bar were used to gain a firm base for accurate corneal reflection measurement.

(ii) Stimuli. Twenty-two segments of varying length were supplied by the Children's Televisior Workshop and these were presented in the same order to all subjects. While order effects are likely, they are also regarded as constant in view of the nature of both the medium and the program. All stimuli were in black and white and all were presented with constant brightness, contrast and back lighting. Volume was held constant for all subjects since no audiometric data was available.

(iii) Initially, 30 children divided on the basis of two reading tests into "poor readers" and non-readers, aged 9 years 2 months to

11 years 6 months were tested. There were 15 children in each group. Twenty-four of the children were boys. This imbalance was forced because of the great difficulty of finding non-reading girls. Three such subjects were available and they were matched in age by girls in the poor reader group. Subsequently, 5 additional girls were added to each group to make the n on which the results of this study are reported to equal 40, divided as follows:

Poor Readers		Non-Readers	
Boys	12	Boys	12
Girls	8	Girls	8

Reven's Progressive Coloured Matrices was administered to both groups and the resultant scores were used with age in months as covariates in subsequent analyses.

(iv) Analysis of Data: (a) Data were analysed statistically through analysis of covariates, using age and intelligence as covariates to the dependant variables of number and duration of fixation.

(b) Qualitative analyses were conducted using a technique of pattern analysis developed by Briggs (1973) employing single frame analysis of 1/16th second fixation point overlaid on position referenced drawings of segment scenes . Composite films of various eye-movement characteristics of the poor readers and non-readers were constructed.

3. Results:

Except where otherwise noted, all of the points made with statistical reference in this summary of results are significant at the .01 level or less. Some of the results are, however, frankly interpretive, since it is the pattern which is "significant" rather than the temporal accumulation

of corneal reflection. The results are presented by sequence in narrative rather than tabular form.

Specific Comments

(a) Bit. (1) See Sam.

There was marked fixation on the print by both poor readers and non-readers in this segment. It was notable however, that poor readers displayed characteristically better patterns than did non-readers who had apparently little or no means of attack on the print. Indeed, this finding is consistent throughout the investigation. Poor readers needed time but did attempt to read. Non-readers were almost always less directive in their e m p s and were often random in their fixation point. Prediction of their pattern was extremely difficult and great inter-subject within group variation was noted in almost all segments.

(2) See Sam Rebus

It was apparent that for both groups this segment was repetitious, but there was evidence that this produced the most effective-looking behaviour in terms of print fixation.

(3) SIt

This segment worked well for the poor reader group. It was especially effective when the large, static SIT appeared but there was significantly greater attention to the actors (especially the gorilla) whenever any action on their part took place. It seems that an increased attention to the static print and longer exposure could be tolerated by the viewers and would result in significantly higher fixation rates being obtained.

(4) Sun

This segment was a very effective visual attention getter. There was good patterning on the follow of the stumulus sun but this resulted in

distraction from the word "sun". One should not be on the screen at the same time as the other--the word is almost certain to lose fixations to the representation of the sun.

(5) Sip

Very few fixations were counted on the word, although the middle letter (i) did draw attention.

(6) See Sam Sit

This is a very good demonstration of the distraction effect likely to occur when a live actor competes with print. Each time Sam talks or waves his fan the eyes tend to leave the print and focus on the man. Sam, in effect, draws attention away from the message.

7. Soda

This section retains the fixation level at a very high rate--but it may be on the massive amount of movement rather than on the print of soda which explodes into a firework display. There is no doubt that this technique is a "grabber" of eye movement variables, however.

8. Swimming

The pointing behavior works partially to direct eye patterns across the print but the movement may be too rapid and the very high degree of repetition together with the accompanying vocalization of the segments of the sentence appear to cause breaks in the pattern of reading. A slower movement, consistent vocalization and some re-elaboration of the print may be useful.

9. Clowns

This is a very effective sequence with a good emp distribution across the print elements. Poor and non-readers were able to handle the words well and most times, were able to attend to the stimulus without undue distraction from competing elements. When there was excessive movement by the clowns behind the words there was substantial loss in fixation.

10. Snip

There was again some value in this segment but most of the foregoing comments held as there was loss of fixation correlated with degree of non-print action.

11. Sap/snap

(See comments for 9 above)

12. Silhouette Blending - without faces

i Very effective and may be of substantial importance. Identical silhouettes might also be tried as some tendency to centre on salient features of the silhouettes was observed. Both bits 12 and 15 produced very good e.m.p's, but the silhouettes without faces proved substantially less distracting than silhouettes with faces. It may be interesting to note that in this and another related study, right to left e.m.p.'s were observed and these appear to have been functionally successful.

It could be that silhouette blending might be a potent factor in establishing a left to right strategy..

13. Telestrator technique

Very effective and indicative of a good use of anticapatory e.m.p. potential.

14. Princess and the Pea

Almost no useful eye movement fixations were observed in this segment--very few children appeared to get the point of the story and all centrations were on or about the general, and quite complex scene.

15. Silhouette Blending with faces

(See comments for 12 above)

16. Doctor, Nurse, Football player

This was a most interesting segment in that the e.m.p. patterns tended to develop a rhythm in keeping with swing of the segment, but very little attention was given to the varying words appearing in the bit. Almost all attention was directed towards the live actors, and words were rarely, if ever, fixated more than once. Often that fixation was of a non-reading duration and might easily represent part of a general scanning of the full and very active stimulus. It does not seem useful as a reading segment--but it had great entertainment value, produced rapid e.m.p. and could well have had very positive motivational effects. When fixations of a reading nature occurred they were primarily on the changing rather than on the constant letters. Some tendency towards increased fixation on the ai was noticed as the segment progressed. It might be a useful technique if used for a long period.

17. Ay

Children, good and bad in reading - adults and experimenters could not follow the ay until at least the third repetition. But the segment is highly motivating and, having discovered the point; the children fixated ay throughout its travels. In a subsequent study when subjects were asked to follow ay the segment worked very effectively.

18. Ladder

Consistent findings in this and all other research conducted by the authors indicate that the person speaking draws almost all e.m.p.s. When the person moves much the same effect occurs. Otherwise the ladder sequence was able to cause attention to the printed sequences. There was evidence however, of confusion of direction of gaze brought about through rather excessive hand movements.

19. Letterman

This segment was second only to the Doctor bit in creating substantial search patterns and vigorous viewing activity - much of the scanning was directed at the activities of letterman, octopus and children, but the cartoon characters point letters and words better than the live actors (in terms of e.m.p.s) perhaps because they often become part of the letter. Children do see the words change, and it seems likely that in spite of the high degree of stimulus degree of stimulus overload in this type of segment there are reading patterns developing. Later studies have tended to confirm this hypothesis.

20. Teaser

The children do show evidence of anticipatory e.m.p.s and aborted reading attempts were made - non-readers gave up quickly - poor readers made more sustained attempts, but few followed through the segment in the time available before being negated.

21. Ow

This segment is very effective in causing attention to moving stimuli - the technique seems promising in that it created vigorous scanning which was often directed towards the moving words and which centered on ow. This segment has been used in research at the masters and doctorate level and the points made above appear to be well substantiated.

22. Why

Children looked at the whole word in this segment, but viewing patterns were often irregular and erratic. Much attention was directed towards the marcher searching for his place and there is some doubt that the word was noted by all viewers and especially by non readers.

General Comments

Differences were noted between poor and non readers in direction of fixation, duration and effectiveness of reading e.m.p.s and perseverance of attack. Non readers rarely attempted the words and did not seem to benefit from increased time. On the other hand, poor readers clearly derived assistance from repetition and extended duration of print on the screen. Again, live actors proved to be highly distracting, but very entertaining (if fast scanning and fixation duration are indicators of attention in this respect). No major sex differences were noted, but the study was not designed for thorough investigation of this aspect. A lack of evidence of left to right scanning strategies was apparent in almost all non readers and in many poor readers. Silhouette blending gave some indication that it might be a useful technique for establishing such strategies. Further research in this area would prove of substantial value as later studies have indicated that this appears to be a major defining

o.m.p. of poor and non-readers. Segments attempting to pretrain attention to acceptable convention may have some value, and pre-attention devices could be explored.